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Variable set laminated core for choke or transformer - has variable air gap between ferromagnetic members and uses inelastic core materials e.g. silicon steel to keep gap at set value

GENERAL ELECTRIC CO PLC 12.11.82-GB-032320

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12.11.82 as 032320 (959NB)

The core comprises an E-shaped member (3) bridged by an I-shaped member (11) so as to form an air-gap (4) adjacent the end face of the centre leg of the former. The I-shaped member is weakened at its centre by a slot (19) and is seam welded (12) at its outer edges to the end faces of the outer legs of the E-shaped member.

The end faces and the corresponding facing surfaces of the I-shaped member define small acute angles at the respective seam welds, enabling the air gap to be set by inelastically deforming the I-shaped member. The leg end faces are coplanar with the I-shaped member. The E-shaped member consists of a stack of laminations lying perpendicular to the lines of contact with the I-shaped member. (5pp Dwg.No.4/5)

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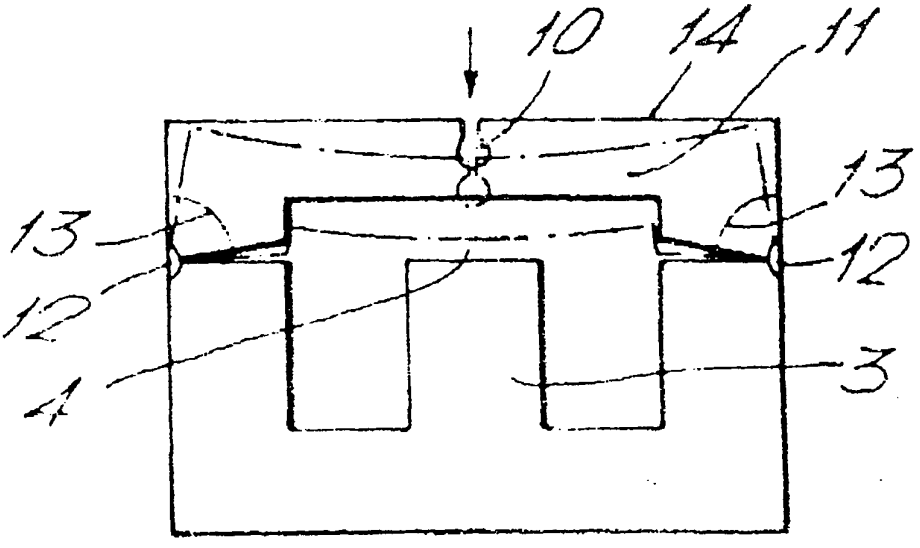

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(71) Applicants The General Electric Company plc, (United Kingdom), 1 Stanhope Gate, London W1A 1EH
(72) Inventor Kenneth Gordon Potts
(74) Agent and/or Address for Service H. V. A. Kirby, Central Patent Department (Wembley Office), The General Electric Company plc, Hirst Research Centre, Wembley, Middlesex HA9 7PP

(54) **Variable set core for choke or transformer**

(57) A laminated core comprises an E-shaped member (3) bridged by a generally I-shaped member (11) so as t form an air-gap (4) adjacent the end face of the centre leg of the former. The I-shaped member is weakened at its centre by a slot (10) and is seam-welded (12) at its outer edges to the end faces of the outer legs of the E-shaped member. The said end faces and the corresponding facing surfaces of the I-shaped member define small acute angles at the respective seam welds, enabling the air gap to be set by inelastically deforming the I-shaped member.

Fig.4.

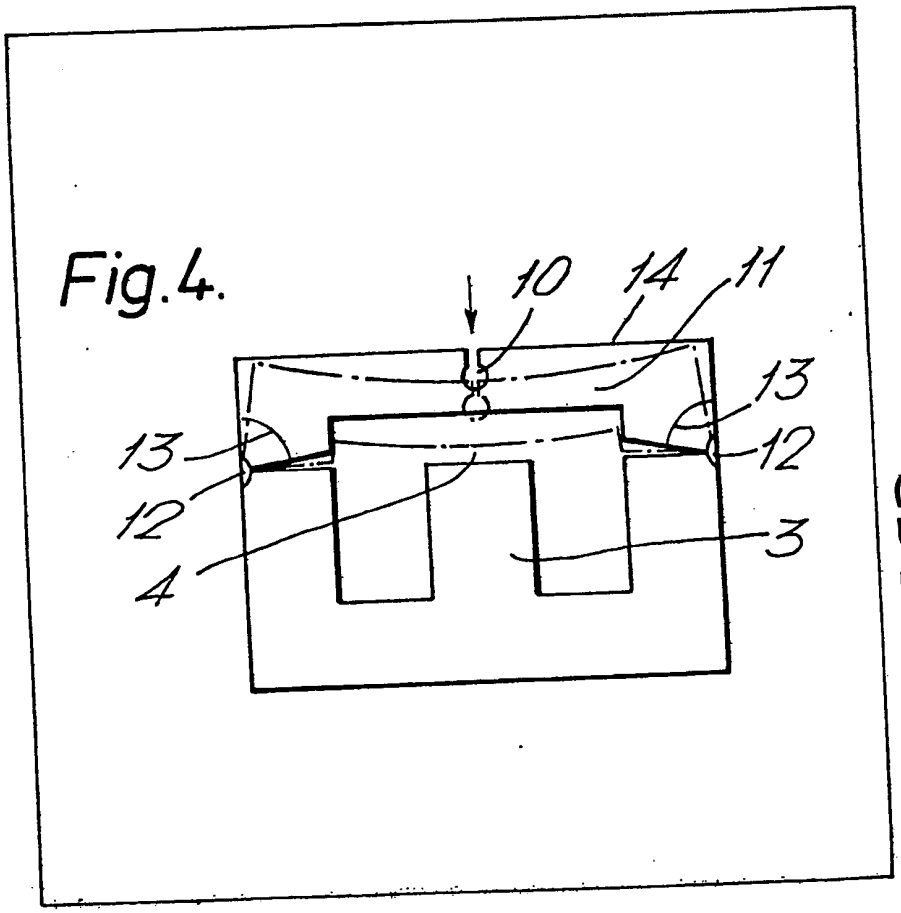

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Fig.1.

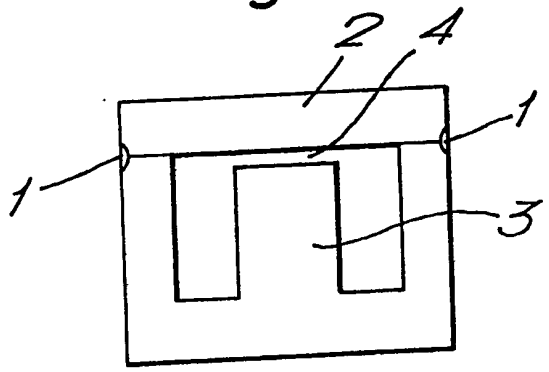


Fig.2.

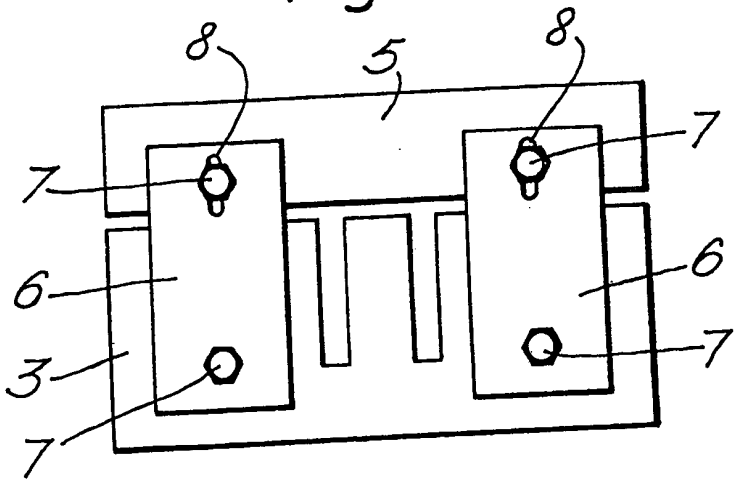


Fig.3.

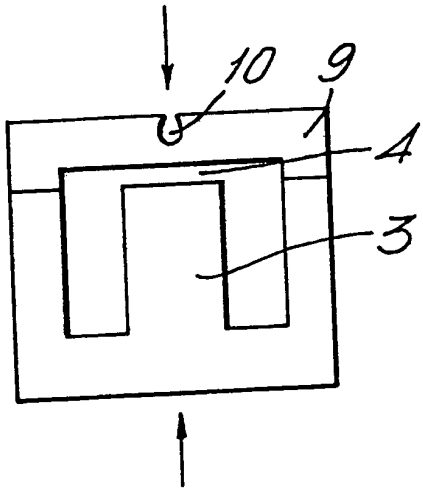


Fig.4.

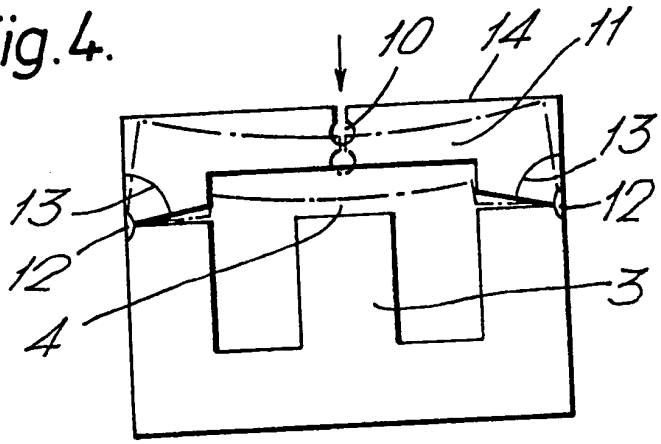
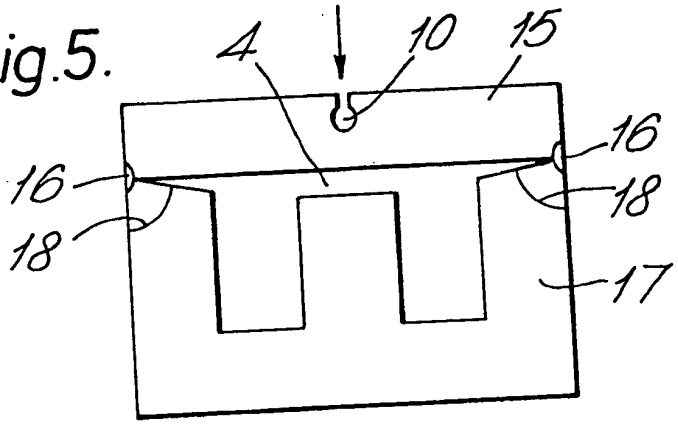


Fig.5.



SPECIFICATION

Variable setch ke

This invention relates to chokes and other electromagnetic devices incorporating ferromagnetic cores having pre-set air gaps and to cores for such devices. More especially, it relates to cores of the type comprising a first member consisting of a stack of E-shaped laminations bridged by a second member consisting of a stack of I-shaped laminations. Hitherto such cores have either been constructed with a fixed air gap between the end face of the centre leg of the E-shaped member and the adjacent face of the I-shaped bridging member by seam-welding the ends of the I-shaped bridging member to the outer edges of the outside legs of the E-shaped member, or have been constructed with a settable air gap by providing adjustable clamping means to hold the bridging member closely adjacent the E-shaped member. Settable chokes have also been made by bridging an E-shaped member having a shortened centre leg with a deformable I-shaped member and clamping the members together by encasing the assembly in mild steel. The air gap between the I-shaped member and the centre leg of the E-shaped member is then set by compressing the appropriate opposite faces of the enclosed assembly. Owing to the low elasticity of mild steel, the I-shaped member does not spring back to an appreciable extent from the centre leg of the E-shaped member when the compressing force is removed, enabling the air gap to be set quite easily. An object of the present invention is to provide an alternative core construction which has advantages over these previous proposals as will be apparent from the following description.

However, before describing the present invention, reference will be made to Figures 1 to 3 of the accompanying drawings, in which

Figure 1 shows a conventional choke core with a fixed air gap

Figure 2 shows a conventional choke with an air gap set by an adjustable clamp

Figure 3 shows a conventional deformable choke core assembly designed to be clamped within a mild steel casing.

Referring to the drawings, Figure 1 shows a welded joint 1 holding an I-shaped bridging member 2 across an E-shaped member 3 having a shortened central leg, thereby forming a fixed air gap 4. This arrangement has the obvious disadvantage that close tolerances in the dimensions of all the components are necessary in order to achieve a reproducable inductance.

Figure 2 shows an I-shaped member 5 clamped to an E-shaped member 3 by insulating clamps 6 which sandwich the core assembly. Two of the bolts 7 pass through elongated holes 8 in the clamps, enabling the distance between the two core members 3 and 5 to be adjusted. This clamping arrangement is liable to becom lo s ned by vibration and mechanical shock, and results in increased manufacturing costs.

Figure 3 shows an I-shaped core member 9 located against an E-shaped core member 3. The assembly is held together by a steel casing (not shown) and the air gap 4 adjusted by compressing the encased assembly in the dir cti ns shown by the arrows, thereby bending the core member in the region of the slot 10. This arrangement is also liable to become loosened and misaligned to a certain extent.

According to the present invention a core for an electromagnetic device includes a first ferromagnetic member which makes line contact with a second ferromagnetic member at two spaced places only, the lines of contact being parallel, at which places it is welded to the second member; and the shapes of the said members are such that the first said member is deformable to vary a gap between part of the first member and part of the second member whilst maintaining said line contact.

The use of welded joints together with the use of conventional inelastic core materials such as silicon steels ensure that the gap remains at a set value when the deforming force is removed, thereby dispensing with the need for a steel casing.

Preferably at least the first said member consists of a stack of laminations lying perpendicular to the said lines of contact. Preferably a slot is formed in the first member between and parallel to the lines of contact on the side of the first member opposite to the said gap. Preferably the first member comprises a stack of I-shaped laminations which are stamped out in a slotted form, so that the slot in the first member is formed by registering the slots in the laminations.

The scope and advantages of the invention will become clearer on consideration of Figures 4 and 5 of the accompanying drawings.

Figure 4 shows an elevation of one example of choke core according to the present invention. An I-shaped member 11 makes contact with an E-shaped member 3 at points 12 where it is seam-welded. The angles 13 are acute, enabling the width of the air-gap 4 to be set by applying a force to the member 11 as shown by the arrow. The member 11 bends mainly in the region weakened by the slot 10, as shown in an exaggerated manner by the dotted lines. Modern conventional core materials such as silicon steels ar sufficiently inelastic for the member 11 to remain in the position indicated by the dotted lines when the force is removed.

The invention therefore provides a simple and permanent method of setting an air gap. Preferably the depth of the slot is at least 40% of the thickness of the I-shaped member. Use of an E-shaped memb r having legs of equal length enables cores without air-gaps (e.g. for transformers) to be made simply by welding E and I shaped members together with the position of the latter reversed, so that the surface 14 abuts the legs, or by welding together the respectiv legs of two oppositely facing E-shaped members.

Figur 5 again shows by way f xample another core construction in accordance with the invention. In this construction an I-shaped member 15 incorporating a slot 10 s am-welded at 16 to an E-shaped member 17. The air-gap 4 is adjusted by deforming the

The drawing(s) originally filed were informal and the print here reproduced is taken from a later filed formal copy.

I-shaped member 15 in th direction shown by th arrow. In this case the I-shaped member has a generally rectangular cross-section, and the angles 18 are acut . It is clear that th inv ntion includes within its scope adaptations and combinations of the examples shown in Figures 4 and 5, as well as chokes and transformers incorporating cores so constructed.

CLAIMS

1. A core for an electromagnetic device, comprising an inelastically deformable first ferromagnetic member which makes line contact with a second ferromagnetic member at two spaced places only, the lines of contact being parallel, at which places it is welded to the said second member, the shapes of the said members being such that the said first member is deformable to vary a gap between parts of the said members whilst maintaining said line contact.

2. A core according to Claim 1 in which a slot is formed in the first member between and parallel to the lines of contact on the side of the first member opposite the said gap.

3. A core according to Claim 1 or Claim 2 in which the said first member consists of a stack of laminations lying perpendicular to the said lines of contact.

4. A core according to any preceding Claim wherein the first member is generally I-shaped, the second member is generally E-shaped and is secured to the first member by seam welds at the ends of the respective outer legs of the E-shaped second member, the said welds constituting the said line contact.

5. A core according to Claim 4 wherein the end faces of the legs of the second member are coplanar.

6. A core substantially as described hereinabove with reference to Figure 4 of the accompanying drawings.

7. A core substantially as described hereinabove with reference to Figure 5 of the accompanying drawings.

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